

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

Civil Action No. 05-30111-MAP

JAMES V. CARIDDI,
Plaintiff

v.

CONSOLIDATED ALUMINUM CORPORATION,
Defendant

AFFIDAVIT OF MICHAEL J. WADE, PHD

I, Michael J. Wade, PhD, upon oath, depose and state that:

1. I have been engaged by the Defendant Consolidated Aluminum Corporation (“Conalco”) to serve as an expert witness in the above-captioned matter. I previously prepared a report dated December 2, 2005 (“Report”) which is attached as Exhibit 1.

2. By way of this affidavit, I affirm my background, experience and training and the opinions provided in my Report and supplement or further explain those opinions in the following paragraphs.

3. I reviewed certain chromatograms which are referenced in my Report. With respect to those chromatograms described in Sections 3.13 and 3.19 (Sample ID L0404535-02, CDI-oil) and Sections 3.14 and 3.17 (Sample ID L0404535-01, *5, CDI-sludge) of my Report, Alpha Analytical Laboratory (“Alpha”) states in its narrative part of its report (page 2 of 11) that with respect to L0404535-01 “[t]he chromatography most closely resembles a mixture of motor oil/waste oil and some type of heavier petroleum product like coal tar,” and that with respect to L0404535-02, that “[t]he Petroleum Hydrocarbon most closely resembles some type of motor

oil/waste oil.” A copy of Alpha’s 11 Page report dated May 11, 2004 is attached as Exhibit 2 (“Alpha’s Report”).

4. The narrative part of Alpha’s Report (page 2 of 11) does not agree with the analytical results provided at pages 3, 5, and 6 of Alpha’s own report. Pages 3, 5 and 6 of Alpha’s Report state there was no detection (or “ND”) of “motor oil” in this sample, specifically making an identification of the presence of an “unknown hydrocarbon” only. Based both on my background and experience, as well as the published technical literature, it is common knowledge that coal tar has a unique chromatographic pattern, one that is not present in the chromatograms for Samples ID L0404535-02, CDI-oil or L0404535-01, *5, CDI-sludge. Thus, Alpha’s characterization of these oil samples as containing coal tar or motor oil and/or waste oil does not agree with its own laboratory findings, is not reliable, and is without scientific basis.

5. Moreover, standard laboratory practices utilized to characterize sampled materials, for example a typical of motor oil and/or waste oil, require a side-by-side comparison of a chromatogram of a known sample of oil with the subject chromatogram. The Alpha’s Report makes no reference to any such side-by-side comparison of a chromatogram of waste oil. No determination as to whether “motor oil/waste oil” is present in a sample can be made from the chromatogram of the subject sample alone. Consequently, the reference to “motor oil/waste oil” in the narrative part of Alpha’s Report (page 2 of 11) is without any scientific support of its own laboratory results, is not scientifically reliable, and is pure speculation.

Signed under the pains and penalties of perjury this 20th day of January, 2006.

/s/ Michael J. Wade, Ph.D

CERTIFICATE OF SERVICE

I, Robert D. Cox, Jr., hereby certify that this document filed through the ECF system will be sent electronically to the registered participants as identified on the Notice of Electronic Filing and paper copies will be sent to those indicated as non-registered participants on January 20, 2006.

/s/ Robert D. Cox, Jr.

EXHIBIT 1

Pages 1 – 9

REPORT OF MICHAEL J. WADE, PH.D.

I. Introduction

I have been engaged by Consolidated Aluminum Corporation ("Conalco") to serve as an expert witness in the litigation commenced by Mr. Cariddi entitled James V. Cariddi v. Consolidated Aluminum Corporation, United States District Court for the District of Massachusetts CA No. 05-30111-MAP. The opinions I provide in this report are limited to those issues relating to the first phase of litigation agreed upon by the parties: the petroleum exclusion under CERCLA and/or M.G.L. c. 21E and "causation" under M.G.L. c. 21E, Section 5(a)(5) as set forth in a Scheduling Order dated July 20, 2005. That Scheduling Order contemplates motions for summary judgment on liability and I anticipate providing an affidavit in support of Conalco's motion to be filed in early 2006.

II. Opinions And Basis And Reasons For Opinions

My opinions, and the basis and reasons for them, are set forth in the attached report dated December 2, 2005. In forming my opinions, I reviewed certain chromatograms referenced in the report and the deposition transcript of Norman R. Lappies dated September 29, 2005.

III. Data Or Other Information Considered In Forming Opinions

The data or other information considered in forming my opinions are set forth in the attached report.

IV. Exhibits To Be Used As A Summary Of Or Support Of Opinions

At this time, I have prepared no exhibits or summaries to support the opinions set forth in my report. To the extent that any such exhibits or summaries are prepared, I will supplement this report and/or provide them in connection with my affidavit in support of Conalco's motion for summary judgment.

V. **Qualifications**

My qualifications, including a list of all publications within the last ten years, are set forth in Exhibit A attached.

VI. **Compensation**

Wade Research, Inc. is being compensated for my time working on this case at a rate of \$250/hour.

VII. **Listing Of Other Cases In Which Expert Testimony Was Provided Within The Preceding Four (4) Years**

Attached at Exhibit B is a list of cases in which I testified as an expert at trial or by deposition.



Dated: December 2, 2005

Michael J. Wade, Ph.D.

Review of Selected Chemical Data

Services on behalf of Consolidated Aluminum Corporation - Claims of James V. Cariddi.

Review prepared for:

Robert D. Cox, Jr., Esquire
Bowditch & Dewey, LLP
P.O. Box 15156
311 Main Street
Worcester, MA 01605-0156

Review prepared by:

Michael J. Wade, Ph.D.
Wade Research, Inc.
110 Holly Road
Marshfield, MA 02050-1724
Tel: 781.837.5504

December 2, 2005

1.0 Introduction

This review of selected chemical data from environmental samples collected at a property located in North Adams, Massachusetts (the Site), was prepared for Bowditch & Dewey, LLP, (Bowditch & Dewey) on behalf of Consolidated Aluminum Corporation. Chemical data in the form of selected laboratory results were provided to Wade Research, Inc. (WRI) for review and comment by Bowditch & Dewey. In addition, information on an aluminum manufacturing process that formerly was located at the Site was provided by Bowditch & Dewey in the form of a deposition transcript taken of Mr. Norman R. Lappies. Mr Lappies was an employee at the former aluminum manufacturing facility. WRI used the testimony transcript to identify all possible petroleum contaminants that could have been present in environmental samples taken from the Site.

2.0 Review of the Deposition Transcript of Mr. N. R. Lappies

Mr. Lappies testified at his deposition as to the type of aluminum manufacturing process in place at the Site during the 1960s and 1970s. As described, the process consisted of cold-forming aluminum tubing using a die and mandrel method followed by heat treating of the final product, i.e., annealing of the extruded tubing (ASM 1993). During his deposition, Mr. Lappies also testified to the use of four petroleum products at the Site as part of the day-to-day manufacturing processes: mineral spirits, kerosene, light finish oil, and a heavy oil. Although he could not identify the supplier of the petroleum products, Mr. Lappies did testify to Sinclair (Sinclair Oil) products (green colored product barrels) being used at the Site and that the number 3041 possibly was associated with one of the products.

3.0 Review of Individual Laboratory Chromatograms

Bowditch & Dewey provided WRI with copies of chemical data from the laboratory analyses of environmental samples collected at the Site. WRI reviewed the data and evaluated the results of the analyses. Section 3.0 provides the results of WRI's evaluation.

3.1 Spectrum Analytical, AC47284.RAW chromatogram. The chromatogram appears to be the result of gas chromatography/flame ionization detector (GC/FID) analysis and is typical of a residual oil. However, the boiling point range is particularly long for this product, indicating that this sample probably was a high heat capacity oil, rather than just a common lubricating oil. Lubricating oil GC/FID chromatograms commonly have a narrower boiling point range. This chromatogram is not a common lube oil chromatogram.

3.2 Spectrum Analytical, DEP SS-1 OILY, File AC47284P.RAW. This particular sample appears to have been analyzed by a different chromatographic method, designated by the lab as Method P60, which is not otherwise specified. The chromatogram shows the residual oil trace at the back part of the chromatogram and also shows additional peaks in a petroleum-fuel based range. The chromatogram is not particularly well done, but it does indicate the presence of two products: the first is most likely a middle distillate fuel, such as a No. 2 fuel oil/diesel fuel, and the second is the high heat capacity oil found in the first Spectrum Analytical chromatogram (Section 3.1). It is not common for two such products to be deliberately blended together, but that possibility can't be ruled out based solely on one chromatogram.

3.3 Spectrum Analytical, DEP SS-1 OILY BROWN. File AC47284.raw. This is an example of a laboratory analysis with an uninterpretable chromatogram. It is typical of an overly concentrated chromatographic analysis of a heavy oil. No other information should be taken from this particular chromatogram.

3.4 Alpha Labs, Sample 10404535-01, Sample Info: 10404535-01, File No. 062R0101.D. A typical GC/FID analysis for total petroleum hydrocarbons (TPH), possibly using U.S. EPA Method 8100. The chromatogram presents a high heat capacity oil, not a lubricating oil per se. The boiling point range is too wide to be a common lubricating oil. Based upon the appearance of the chromatogram, the product is suspected to be a metal-treating oil or a quenching oil in this sample. No petroleum fuels apparent in this chromatogram. The laboratory placed an internal standard (o-terphenyl) into the sample as part of its analysis and this compound is the prominent peak labeled as such apparent at approximately 15 minutes.

3.5 Alpha Labs, blank sample ID, Sample Info: 10404535-02, File No. 060R0101.D. The chromatogram is a typical lubricating oil GC/FID chromatogram. The lubricating oil is probably a common motor oil, such as a 30 weight motor oil. This analysis was probably used by the laboratory for identification purposes for Sample 10404535-01 discussed in Section 3.4 immediately previous.

3.6 Maxymilliam Sample ID SB-1, File No. TPH-004.D. This particular chromatogram resulted from a TPH analysis procedure apparently being done on a gas chromatograph/mass spectrometer (GC/MS). The result is an overly dilute analysis of what presents as a low level residual petroleum hydrocarbon product. It does not appear to be a typical lube oil chromatogram. A laboratory internal standard used by Maxymilliam appears as the prominent peak at approximately 26 minutes in the chromatogram.

3.7 Maxymilliam Sample ID SB-2, File No. TPH-005.D. This particular chromatogram also resulted from a TPH analysis procedure apparently being done by GC/MS. The result is an overly dilute analysis of what presents as a low level residual petroleum hydrocarbon product. It does not appear to be a typical lube oil chromatogram. A laboratory internal standard used by Maxymilliam appears as the prominent peak at approximately 26 minutes in the chromatogram.

3.8 Maxymilliam Sample ID SB-3, File No. TPH-006.D. Again, a GC/MS analysis for TPH with the same result as for samples SB-1 and SB-2 discussed immediately above. However, low level petroleum hydrocarbons are starting to manifest themselves in the 16 to 24 minute range, which in this analysis will be the mid-range distillate fuel range. Again, the sample was overly dilute, so it is difficult to say much beyond an overall characterization of residual petroleum product present.

3.9 Maxymilliam Sample ID SB-4, File No. TPH-007.D. A GC/MS analysis for TPH with the same result as for samples SB-1, SB-2 and SB-3 discussed immediately above. Again, the sample was overly dilute, so it is difficult to say much beyond the presence of a residual range petroleum product. This is a typical example of bad chromatographic work from overly dilute sample preparation.

3.10 Unknown Laboratory, Chromatogram from File No 020F0101.D. The chromatogram apparently is a lubricating oil standard, possibly analyzed by Maxymilliam, but this particular chromatogram is not labeled as to origin. The laboratory printed the retention times of each peak immediately over the peak, effectively obscuring any chromatographic detail.

3.11 Unknown Laboratory, Chromatogram from File No. 019F0101.D. The chromatogram apparently is another lubricating oil standard used by this particular lab. Again, printing the retention time above each peak effectively obscures details of the chromatogram.

3.12 Unknown Laboratory, Chromatogram from File No. 018F0101.D. The chromatogram apparently is another laboratory standard used by this particular lab, an automobile motor oil, labeled a 10W oil, but probably not a pure 10W oil. The sample is more likely a 10W30 motor oil. Again, printing the retention time above each peak effectively obscures details of the chromatogram.

3.13 Unknown Laboratory, Method HP5890 GC Chromatogram of Sample ID L0404535-02, CDI-oil. This is a typical chromatogram of a wide-boiling point oil (with attendant high heat capacity) that was designed either as a quenching oil or a metal-treating oil. The analysis was completed on May 7, 2004. For this chromatogram, no distillate fuel petroleum hydrocarbon peaks are

apparent where expected, in the 4-12 minute range. The presence of a deliberately-added laboratory internal standard (not otherwise identified) can be seen in the prominent peak found at approximately 14.7 minutes.

3.14 Unknown Laboratory, Method HP5890 GC Chromatogram of Sample ID L0404535-01, *5, CDI-sludge. This analysis was also completed on May 7, 2004. The chromatogram is typical of a wide-boiling point oil, plus other non-petroleum product peaks, probably representing either other sources of peaks from other products (not identified), or a degraded heavy oil, burned from over use, for example, containing degradation product hydrocarbons presenting as individual peaks found at 12-20 minutes in the chromatogram. The presence of a deliberately-added laboratory internal standard (not otherwise identified) again can be seen in the prominent peak found at approximately 14.7 minutes.

3.15 Unknown Laboratory, Method HP5890 GC Chromatogram of Sample ID L0407454-01, MW-3-oil. This particular sample has a different log in number from the samples discussed in Sections 3.13 and 3.14, but otherwise appears to have been analyzed by the same laboratory in the same manner. However, the sample was analyzed at a different time. Sample MW-3-oil represents a two product mixture: a heavy oil and a degraded distillate fuel. The CDI-oil and CDI-sludge chromatograms are sufficiently different from the MW-3-oil that the heavy oil is probably not the same heavy oil found in the CDI-oil and CDI-sludge samples. No laboratory standards of either n-alkanes or distillate fuel(s) were provided with this work, but it is likely that the petroleum peaks are relatively degradation resistant isoprenoid hydrocarbons found in a pattern similar to a distillate fuel. However, specific individual peak identifications in the distillate fuel range can't be made from these data alone. Regardless of the resident uncertainty of the isoprenoid hydrocarbon pattern due to the low peak heights, it is apparent that there are two different products in sample MW-3-oil. The presence of a deliberately-added laboratory internal standard (not otherwise identified) again can be seen in the prominent peak found at approximately 15.2 minutes.

3.16 Unknown Laboratory, Method HP5890 GC Chromatogram of Sample ID L0407454-01 *10, MW-3-oil. This chromatogram represents a simple blow up of the previous chromatogram discussed in Section 3.15. This type of side-by-side comparison is used to qualitatively identify petroleum product(s).

3.17 Unknown Laboratory, Method HP5890 GC Chromatogram of Sample ID L0404535-01 *5, SDI-sludge. This chromatogram represents a simple blow up of the previously discussed chromatogram in Section 3.14. From this particular side-by-side comparison of the two chromatograms, it is apparent that the two residual (i.e., heavy) oils may not be the same oils. But as the

laboratory internal standards are not eluting at the same retention time, it is perilous to compare these two chromatograms without also comparing the detailed data from the corresponding peak area and peak height data files that also were generated each of these chromatograms. A cautious reader should be wary of any interpretation of these two chromatograms without a detailed numeric analysis of the results.

3.18 Unknown Laboratory, Method HP5890 GC Chromatogram of Sample L04077454-01 *10, MW-3-oil. This chromatogram represents a simple blow up of the previous chromatogram discussed in Section 3.15. This type of side-by-side comparison is used to qualitatively identify petroleum product(s).

3.19 Unknown Laboratory, Method HP5890 GC Chromatogram of Sample ID L0404535-02, CDI-oil. This chromatogram represents a simple blow up of the previously discussed chromatogram in Section 3.15. Again, from this particular side-by-side comparison of the two chromatograms, it is apparent that the two residual (i.e., heavy) oils may not be the same oils. But as the laboratory internal standards are not eluting at the same retention time, it is perilous to compare these two chromatograms without also comparing the detailed data from the corresponding peak area and peak height data files that also were generated each of these chromatograms. A cautious reader should be wary of any interpretation of these two chromatograms without a detailed numeric analysis of the results.

4.0 General Environmental Behavior of the Identified Petroleum Products.

From the testimony of Mr. Lappies, potentially four petroleum products likely were to have been released in the 1960s and 1970s at the Site during normal aluminum production activities: mineral spirits, kerosene, light oil and heavy oil. The expected environmental persistence of these four petroleum products thus becomes important in light of the laboratory findings. The question simply becomes: can any of the petroleum products identified by the chromatographic results be characterized as mineral spirits, kerosene, light oil or heavy oil. Such questions are evaluated by applying the scientific method.

Therefore, applying the scientific method, the null hypothesis becomes:

H₀: Release of each petroleum product has been identified by the chromatographic results.

And the alternate hypothesis becomes:

H₁: Release of each petroleum product has not been identified by the chromatographic results.

Due to the quality of most of the chromatographic work, only the chromatograms from the analysis of samples MW-3-oil, CDI-oil, and CDI-sludge will be considered in evaluating the null hypothesis. All other chromatographic results are not considered further.

WRI did not have direct oversight of either the field sampling conducted at the Site nor the subsequent laboratory analyses of collected samples. WRI has not undertaken to independently verify adherence to field and laboratory protocols or the accuracy of the laboratory and other data on which this information is based. WRI's conclusions from this review are expressly conditioned on the validity of the underlying information, a matter as to which WRI expresses no opinion at this time, and relies fully on all representations made by other parties. WRI reserves the right to amend or modify its opinion(s) in this matter, if necessary, after review of any newly-provided chemical data or information regarding sample collection or chemical analysis.

4.1 Mineral Spirits. Mineral spirits is a general term for a mixture of petroleum-derived hydrocarbons in the boiling point range of 318 - 383 °F (MSDS, Cumberland Products, 1997). Generally, the mixture mineral spirits is composed of partially hydrogenated naphthenic compounds. A mineral spirit boiling point range corresponds to a normal alkane range (n-alkanes) of approximately n-C9 to n-C11. Under common gas chromatographic conditions of petroleum hydrocarbon analysis, this is a very narrow boiling point range most likely found in the immediate front part of a typical TPH chromatogram (ASTM 21004). No such narrow distribution was found in any of the chromatograms reviewed in this work. Therefore, the null hypothesis must be rejected for mineral spirits and the alternate hypothesis accepted that the presence of mineral spirits was not established by the chromatographic analyses reviewed.

4.2 Kerosene. Kerosene is a general term for a mixture of petroleum-derived hydrocarbons found in the light distillate range, with a boiling point range of approximately 300 - 570°F, corresponding to an n-alkane range of n-C9 - nC16 (WHO 1989). Petroleum products in this boiling range are well known to undergo environmental weathering reactions (Christensen and Larsen, 1993; Murphy and Morrison, 2002; Wade, 2001 and 2005). However, environmental weathering resulting in hydrocarbon degradation is seldom absolute (Christensen and Larsen, 1993; Wade 2005) and residual hydrocarbons from distillate fuel degradation often remain. Some of these hydrocarbons that will remain after extensive normal alkane hydrocarbon degradation has occurred are termed isoprenoid hydrocarbons. Review of the chromatogram for MW-3-oil revealed the presence of

a boiling point range characteristic of a distillate fuel. Further, some of the resolved peaks found in the range of 3 to 12 minutes in the MW-3-oil chromatogram, in fact, may be these isoprenoid hydrocarbons. However, from the lab results available, it is not possible to determine which isoprenoid hydrocarbons may be present, nor what the boiling point range of kerosene was under the specific laboratory conditions of the MW-3-oil TPH analysis, and therefore it is impossible to determine if the distillate fuel present in MW-3-oil is kerosene, No. 2 fuel oil, or diesel fuel. The data needed to complete such an evaluation simply were not made available. Therefore, the null hypothesis must be rejected for kerosene and the alternate hypothesis accepted that the presence of kerosene was not established by the chromatographic analyses reviewed.

4.3 Light Oil. The term "light oil" is non-scientific. In order to somewhat simplify the issue, it is recognized that application of the term "light oil" was a layman's description of what was probably some type of light machinery low viscosity cutting or finishing oil. Such low viscosity oils generally have a boiling point range of 200 - 400°F in the n -C7 to n-C11 range, and are composed of distillate hydrotreated naphthenic and dewaxed paraffinic distillate hydrocarbons (Sinclair Oil Company, MSDS medium cutting fluid). Under conditions of the petroleum hydrocarbon analyses as conducted approximately half of such a n-C7 to n-C11 hydrocarbon distribution would not be found, even if present in large quantities. Certainly, such an n-C7 to n-C11 naphthenic distribution was not present in the chromatograms reviewed. Any exact identification of the specific "light oil" as testified to by Mr. Lappies was not established by the chemical analyses provided to WRI. Therefore, with the data available, the null hypothesis must be rejected for "light oil" as used at the Site and the alternate hypothesis accepted that the presence of "light oil" was not established by the chromatographic analyses reviewed.

4.4 Heavy Oil. The term "heavy oil" is non-scientific. Considering common hydraulic oils and motor oils, the general boiling point range of such materials is greater than n-C30, or having an initial boiling point range of >800°F. However, with the understanding that the application of the term heavy oil was a layman's description of what was probably some type of heavier lubricating oil, it can be concluded that the presence of a heavy residual high viscosity petroleum product of a type of lubricating oil definitely was established by the chromatographic results. However, the exact source of this residual petroleum product is not clear. Review of the chromatograms from samples MW-3-oil, CDI-oil, and CDI-sludge revealed that the residual product found in MW-3-oil is not the same as that found in the CDI-oil or CDI-sludge samples. Without a sample of the "heavy oil" as used at the Site during aluminum tube production, it is not possible to determine if the residual petroleum product found in environmental samples at the Site is, in fact, the same "heavy oil" that was used in the manufacturing process. Review of the

chromatographic data revealed that the residual product had a broad boiling point range, and that the product probably was formulated for its stability under high heat conditions, in contrast to typical motor oil and hydraulic oils, for example. However, any exact identification of the specific "heavy oil" as testified to by Mr. Lappies was not established by the chemical analyses provided to WRI. The data needed to complete such an evaluation simply were not made available. Therefore, with the data available, the null hypothesis must be rejected for "heavy oil" as used at the Site and the alternate hypothesis accepted that the presence of "heavy oil" was not established by the chromatographic analyses reviewed.

Further, a laboratory characterization that the heavy oil found in the CDI-oil and CDI-sludge represented "a mixture of motor oil/waste oil and some type of heavier petroleum product like coal tar" is incorrect. The chromatograms for these two samples in no way presents a coal tar contribution. Moreover, the laboratory did not supply a chromatogram of a typical waste oil for comparison, making the identification of motor oil/waste oil pure speculation.

5.0 References

ASM. 1993. Metals Handbook. Ninth Edition, Volume 14 Forming and Forging. Prepared under the direction of the ASM International Handbook Committee, S.I. Semiatin, Chairman. ASM International, Metals Park, Ohio.

ASTM. 2004. Designation D 2887-04. Standard test method for boiling range distribution of petroleum fractions by gas chromatography. American Society of Testing and Material International. West Conshohocken, PA, USA.

Christensen, L.B., Larsen, T.H. 1993. Method for determining the age of diesel oil spills in the soil. Ground Water Monitoring and Remediation. Fall. Pages 142 - 149.

Murphy, B.L., Morrison, R.D. 2002. Introduction to Environmental Forensics. Academic Press, San Diego. 560 pages.

Wade, M.J. 2001. Age-Dating Diesel Fuel Spills: Using the European Empirical Time-Based Model in the USA. Environmental Forensics 2, 347-359.

Wade, M.J. 2005. The Use of Isoprenoid Ratios to Calculate Percentage Mixing of Different Distillate Fuels Released to the Environment. Environmental Forensics 6 (2), 187-196.

WHO. 1989. World Health Organization. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Occupational Exposures in Petroleum Refining: Crude Oil and Major Petroleum Products. IARC, Lyon, France. 322 pages.

6.0 Signature Page

This report was prepared by Wade Research, Inc., Michael J. Wade, Ph.D., Principal Scientist.

A handwritten signature in black ink, reading "Michael J. Wade". The signature is written in a cursive style with a large initial "M".

Michael J. Wade, Ph.D.

EXHIBIT 1

Continued Pages 10 – 14

Michael J. Wade, Ph.D.

Education

Ph.D. University of Rhode Island - 1979

B.A. Grinnell College - 1968

Qualifications

Dr. Michael J. Wade is Principal Scientist of Wade Research, Inc.[™], a small business that provides geochemical consulting services to a variety of government agencies, industrial clients, and law firms. Dr. Wade is an organic geochemist with 26 years post-doctoral experience with an overall total of 32 years of strong technical and project management experience in a variety of research programs with special emphasis on study of petroleum pollution in the environment. He regularly provides expert testimony services both through deposition process as well as court testimony in the areas of environmental contamination, including assessment of sources of contamination, identification of petroleum product types and age-dating of petroleum product releases.

Dr. Wade's general areas of geochemical expertise are evaluation of the detailed hydrocarbon composition of petroleum products; assessment of the degradation of petroleum hydrocarbons in the environment; innovative hydrocarbon fingerprinting techniques; source identification for polychlorinated dibenzo-*p*-dioxins (PCDD) and dibenzofurans (PCDF) in the environment; development of bioremediation approaches for chlorinated and aromatic hydrocarbons, and chlorinated and phosphorus pesticides in contaminated soils and sediments; impacts of waste disposal outfalls in the coastal ocean for both industrial and municipal wastes; natural resource damage assessments for major oil spills in U.S. coastal waters; Phase I and Phase II Environmental Assessments; and analytical method development for a variety of organic chemical pollutants.

As part of the current assignment mix, Dr. Wade is engaged in the conduct of several projects dealing with the various aspects of environmental assessment, including assessment of the degradation of petroleum hydrocarbons in underground soils, development of quantitative hydrocarbon fingerprinting techniques that identify sources of subsurface petroleum contamination, and quantitative assessment of fluxes of petroleum hydrocarbons to the coastal marine environment. Over the past ten years working through Wade Research, Inc., he has refined quantitative field and laboratory investigation approaches that are designed to establish time frames for the release of gasoline, kerosene, diesel fuel and heavier fuel oils in subsurface petroleum contamination cases. These approaches currently measure geochemical differences in petroleum contamination

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originating from sudden releases of petroleum products in the environment and compares the result to releases occurring over a number of years. The overall approach includes the calculation of time horizons for the release of a variety of petroleum products to the environment. Annually, through Wade Research, Inc., Dr. Wade conducts approximately 20 to 30 such programs for clients throughout North America.

Further, Dr. Wade has conducted numerous geochemical programs for state and Federal agencies that have documented the impacts of chemical pollution in the environment, including the U.S. Environmental Protection Agency (EPA) National Monitoring Program for Tributyltins in the Marine Environment; the U. S. Navy's Biomonitoring Program at NWS Earle, New Jersey; the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency contaminated sediment remediation program in New Bedford, Massachusetts; the Massachusetts Water Resources Authority's Massachusetts Bay Ocean Outfall Siting Study; the Massachusetts Water Resources Authority's Massachusetts Bay Ocean Outfall Monitoring Study; the U.S. Department of the Interior, National Park Service Bioremediation project at Boston Naval Shipyard; the South Atlantic Bight Benchmark Program; the joint oil and gas industry-U.S. EPA 10 Platform Study in the Gulf of Mexico.

Employment History

Immediately prior to starting his own geochemical consulting company in November 1992, Dr. Wade was first a Senior Consultant and then promoted to a Director of the Environmental, Health and Safety Practice at Arthur D. Little, Inc., Cambridge, Massachusetts. Previously, Dr. Wade served as Associate Section Manager for Battelle Memorial Institute, Duxbury, Massachusetts, and as Vice President of ETC Corporation, Dallas, Texas. Early in his career Dr. Wade was an environmental scientist with Gibbs and Hill, Inc., a subsidiary of Dravo Corporation; and a chemical oceanographer with Texas Instruments, Incorporated, in Dallas, Texas. During graduate school in the early 1970s, Dr. Wade served as an organics team chemist at the United States Environmental Protection Agency, Environmental Research Laboratory, Narragansett, Rhode Island for over two years.

1992-Present	Wade Research, Inc., Marshfield, MA
1989-1992	Arthur D. Little, Inc., Cambridge, MA
1986-1989	Battelle Memorial Institute, Duxbury, MA
1984-1986	ETC Corporation, Dallas, Texas
1981-1984	Dravo Corporation, Dallas, Texas
1977-1981	Texas Instruments, Inc., Dallas Texas

Michael J. Wade, Ph.D.

Professional Affiliations

American Chemical Society (ACS)
American Society of Limnology and Oceanography (ASLO)
Eco-Ethics International Union (EEIU) - Fellow
International Society of Environmental Forensics (ISEF)
Society of Environmental Toxicology and Chemistry (SETAC)

Professional Courses Taught

1989. *Managing an Environmental Chemistry Business*. Arthur D. Little, Inc., Cambridge, Massachusetts. Series of technical courses given throughout the United States by a combined team of Arthur D. Little, Inc. and Hewlett-Packard, Inc. scientists during October - December 1989.

1992. *Oil Spills: Efficient and Effective Management*. Innovative or Contested Methods - Bioremediation. Course taught at Arthur D. Little, Inc., Cambridge, Massachusetts in May 1992.

1995. *Sources, Fate and Effects of Polycyclic Aromatic Hydrocarbons (PAHs) in Massachusetts Bays: The Science Behind the Management Issues*. Sources and Fate of PAHs in Massachusetts Bays. Wade Research, Inc. Course taught at the Faculty Club, University of Massachusetts/Boston. Sponsored by the Massachusetts Bays Program. Coordinated by the Massachusetts Bay Marine Studies Consortium, Boston, Massachusetts.

1995. *The Use of Experts in Environmental Matters. From Permitting to Litigation*. Wade Research, Inc. Course taught at the Massachusetts Continuing Legal Education Inc. (MCLE). Boston, Massachusetts.

2002. *Environmental Chemistry and the Emergence of Forensic Geochemistry*. Wade Research, Inc. Course taught in Massachusetts as part of the Licensed Site Professional Association Continuing Education Series, Licensing Requirements, Woburn, Massachusetts.

2003. *Environmental Chemistry and the Emergence of Forensic Geochemistry*. Wade Research, Inc. Courses taught in Massachusetts as part of the Licensed Site Professional Association Continuing Education Series, Licensing Requirements, Woburn, Massachusetts.

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2005. *Forensics in Environmental Geology: Petroleum and Chlorinated Hydrocarbons*. Wade Research, Inc. Course taught at the North-Central Section, Geological Society of America, Annual Meeting, held at the University of Minnesota - Twin Cities, Minneapolis, Minnesota. May 19, 2005.

2005. *Environmental Forensics: Focus on Emerging Contaminants*. MtBE Groundwater Monitoring Data: Can You Trust Your Data and What Questions Do You Ask in Deciding? Session taught at the International Society of Environmental Forensics Workshop, held at Virginia Beach, Virginia. June 7, 2005.

Papers Presented

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